Composite Structure Tooling Method Reduces Fabrication Times and Costs

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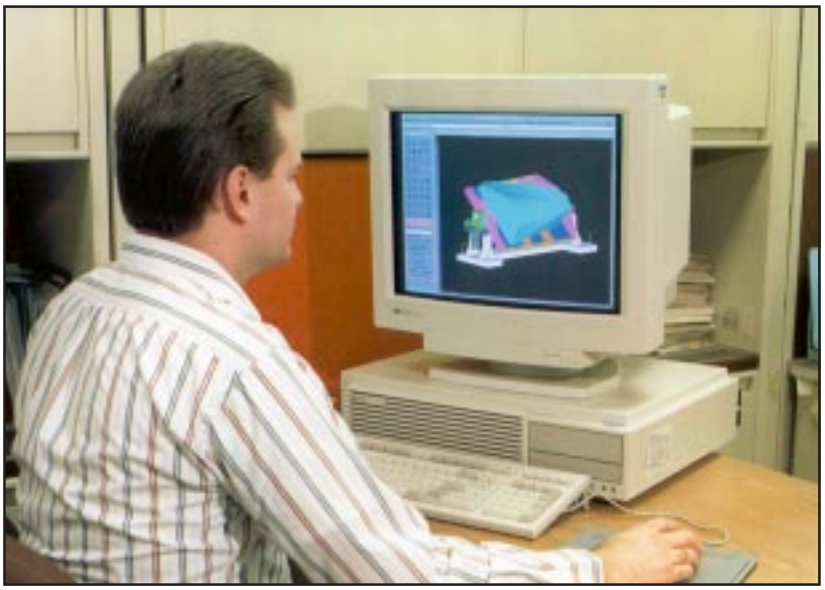

Payoff

The application of the new tooling methods for composite structures may lead to significantly reduced tool fabrication costs and fabrication cycle times. This methodology has been used to fabricate bond tools for prototype aircraft at Boeing-St. Louis.

Accomplishment

Under a cooperative agreement program between the Defense Advanced Research Projects Agency (DARPA) and Boeing-St. Louis, and managed by the Materials and Manufacturing Directorate (ML), a new approach for reducing the costs of tooling for composite structures was developed and demonstrated. Their new low-cost method lowers the overall bond tool family costs by minimizing the total number of tools in a family, thus, reducing fabrication cycle times.

Background

In the past, tooling for complex contour composite structures represented a major up-front cost driver, as well as one of the longest lead time elements, for any prototype or production program. Over time, bond tools fabricated from composite systems emerged as the answer to the challenge of making complex contour tooling for composite structures. However, while the use of composite materials made the tooling much easier to fabricate, lead times and fabrication costs were still very high because several tooling generations were required to obtain the final product. Traditionally, the final bond tool was the fourth generation in the overall tooling family. First, the template setups were made and splined together to form a master model tool. Then, typically, plastic-faced, plaster-splashes were cast from the master model. Next, the splash was used to generate a room temperature/high temperature facility tool that was made from wet laid-up carbon/epoxy. Finally, the facility tool was used to generate the bond tool made from high temperature, autoclave curing carbon/epoxy tooling systems. With the onset of the low temperature, non-autoclave curing epoxy tooling systems capable of withstanding 350°F autoclave use, the typical approach to composite tool fabrication proved costly and outdated. The major thrust of the new tooling philosophy was to minimize the number of tools in a family in order to reduce fabrication costs and fabrication cycle times. The most dramatic change is the adoption of an electronically stored tool master model. From this model, a disposable facility tool can be machined from low-cost materials, such as high-density foams or tooling doughs. Then, using the low cost facility tool as a form, the final bond tool can be laid-up using low temperature, non-autoclave-curing epoxy tooling systems. As a result, the number of tool generations required to develop a part is reduced from four to two.